file

# Maine Department of Agriculture

Sent 7/6/81

Stewart N. Smith, Commissioner

REPLY TO:

MAINE SOIL and WATER
CONSERVATION COMMISSION

Frank W. Ricker, Executive Director
State House Station 28
State Office Building, Augusta, Maine 04333
Telephone 207/289-2666

July 2, 1981

Office of Selectmen
Town of Stoneham
East Stoneham, Maine 04231

Mr. Carleton Barker, Jr.
East Stoneham
Maine 04231

Gentlemen:

Enclosed herewith is the draft report of Robert Gerber, Inspector of Dams, relating to the Keewaydin Lake Dam owned by the Town of Stoneham, Maine.

As noted on the enclosed cover letter to Commissioner Smith, comments may be filed on this report in care of this address up to 14 days from your receipt of same.

Exhibits 1 & 2 and the bulky "Computer Printout of Flood Analysis" noted in the Table of Contents have not been forwarded, but are available for inspection at the office of the Department of Agriculture, Food and Rural Resources during business hours.

Sincerely,

Frank W. Ricker

Frank W. Ricker
Executive Director
Maine Soil & Water
Conservation Commission

FWR:sc

cc: Stewart N. Smith
Jeffrey Frankel
Robert Gerber

ROBERT G. GERBER
ASH POINT ROAD • SOUTH HARPSWELL, MAINE 04079
207-833-6334

19 June 1981

Mr. Stewart Smith, Commissioner
Maine Department of Agriculture, Food & Rural Resources
State Office Building
Augusta, Maine 04333

Re: Transmittal of draft report of Keewaydin Lake Dam Inspection, Stoneham, Me.

Dear Mr. Smith:

The Selectmen of Stoneham, Maine, petitioned me as Inspector of Dams to inspect the Keewaydin Lake dam. The petition was filed pursuant to 38 MRSA 811 and was received on 17 March 1981. An inspection was made on 21 April 1981 and a hearing was held in the East Stoneham school house at 7PM EST of the same evening to hear "the testimony of witnesses summoned for the purpose."

I deliver herewith my findings and opinion as to the safety and sufficiency of the dam and whether such dam is "unsafe or dangerous to the lives or property of persons residing, carrying on business or employed near or below the same..." This is a draft report and the owners and intervenor may file comments on this report up to 14 days of their receipt of this draft report.

The owner of the dam is the Town of Stoneham. They shall be notified of these findings by sending correspondence to: Office of Selectmen, Town of Stoneham, East Stoneham, Maine 04231. At the hearing, I granted intervenor status to Mr. Carleton Barker, Jr., East Stoneham, Me. 04231, and he should also be sent a copy of these draft findings.

Sincerely,

Robert D. Gerber

Robert G. Gerber, P.E. 3165
Inspector of Dams, State of Maine

DRAFT REPORT

# Inspection of the Keewaydin Lake Dam
East Stoneham, Maine

Owned by the Town of Stoneham, Me.

pursuant to 38 MRSA 811 et.seq.

by

Robert G. Gerber, P.E. 3165

State of Maine Inspector of Dams

19 June 1981

Table of Contents

KEEWAYDIN LAKE DAM INSPECTION, EAST STONEHAM, MAINE

Methods and Limitations of the Inspection

The State of Maine Inspector of Dams must necessarily do a rather cursory inspection of any dam that he is required to evaluate. His total annual budget is only $3000, and the legislation under which he works does not direct him to do exhaustive studies and evaluations. The Inspector must rely primarily upon his experience and his observation of the dam during a site inspection. There is obviously a great danger to the public in declaring a dam safe if in fact it is not; conversely, it does great disservice to the dam owner to require excessive repairs or alterations if they are not required. In the balance, however, the scales must be tipped to erring on the side which provides the greatest degree of protection to the public. Since I will, therefore, be very conservative in my analysis, it is incumbent upon the dam owner to supply as much information as possible to the Inspector concerning the construction, operating record, and design basis of the dam in question.

This inspection of Keewaydin Lake Dam draws upon the following information:

a) my personal inspection of the dam and other features of the watershed that control the hydrologic response at the dam;

b) stadia topographic survey near the dam in order to establish correct spatial and vertical relationships of features controlling the hydrologic response at the dam;

c) a computerized evaluation of the hydrology of the watershed using the USDA, SCS, TR20 program;

d) testimony and documents obtained at the hearing;

e) research of my own into flood histories in the area;

f) my own engineering and hydraulic calculations in analyzing the safety of the dam;

g) the U.S. Geological Survey maps(East Stoneham, North Waterford, and Speckled Mountain 7½' quadrangle maps) that cover the watershed area;

h) my own photography of the pertinent features related to dam safety.

A hearing, which was advertised in the local newspaper, was held on the day of the dam inspection. Testimony was taken from the public and the proceedings were recorded by a court reporter, but a transcript has not yet been prepared.

Findings

1. The dam occupies the site of a mill dam that was built from wood in the 1800's. Conflicting testimony was delivered at the hearing by local residents as the height of the former dam relative to the present dam. A Mr. Littlefield claimed that the old dam was 6 feet higher than the present dam. Carleton Barker, Jr., claimed that the old wooden dam was one foot higher than the present dam. It was later stated that the present lake level is 2 to 2½ feet lower than it was before the old wooden dam was replaced. The present Keewaydin Lake dam is a concrete and concrete-faced masonry dam about 180 feet long, located about 200 feet north of Rt. 5, north of East Stoneham village. The Town purchased the old mill dam in 1936 and replaced it with a concrete dam about 1954. In 1974, the spillway section of the dam was replaced with concrete and additional new

concrete was placed in other parts of the dam.

2. The Town of Stoneham owns the dam but was unable to provide plans of the layout and construction of the dam and ancillary structures. Other than general verbal descriptions offered at the hearing, my field notes and survey measurements must serve as the basis of my evaluation of the safety of the dam. I have attached a sketch (Fig. 1) which shows the location of the dam relative to the Route 5 bridge, and the elevations and locations of the major features of the dam and surrounding area. Elevations are referenced to an arbitrary benchmark established on the northwestern wingwall of the Rt. 5 bridge. Specific details concerning the structure are recorded in my survey notes. Table 1, attached, summarizes the most important features of Keewaydin Lake Dam, as well as Virginia Lake Dam.

3. Carleton Barker, Jr., operates the Keewaydin Lake Dam for the Town of Stoneham. He has never kept records on the operation of the dam. He testified that the position of the flashboards on 4/21/81 was the position that the boards were normally kept and that they had not been moved in two years. In the past, boards were sometimes removed in March to assist in the safe handling of spring runoff. The planks have frozen in place as recently as February 1981.

4. This is no written information on foundation conditions at the dam. Carleton Barker testified that when the spillway was rebuilt in 1974 that it was placed on, but not pinned to, bedrock. There are bedrock outcrops (granite) near the dam, but not at the dam itself. Mr. Littlefield testified that a portion of the present concrete dam is underlain by large timbers. The soil under and near the dam appears to be a sandy glacial till. There is no Soil Conservation Service soil mapping nor any surficial geology map available for the area.

5. The Selectmen of Stoneham requested this inspection because a severe storm on Dec. 3 & 4, 1980, caused overtopping of the dam and some washouts just below the dam. Carleton Barker testified that 10-foot waves that were created by 85 mile-per-hour winds caused ice on the Lake to break up, move toward the dam, and clog the spillway. Water was observed to squirt out from the cracks in the dam. Fig. 1 shows the location of the major cracks in the dam. These cracks are relatively vertical. There is also a relatively horizontal crack half-way up the lake-side of the middle of the eastern wing of the dam. I have marked areas on Fig. 1 as "erosion" where it appears to me that overtopping of the dam has eroded surface soils. A portion of the concrete apron on the east side of the spillway has been undercut. Mr. Barker testified that he felt that some of this eroded soil was due to "leakage" through or under the dam.

6. The Keewaydin Lake Dam passes water from an 8.8 square mile drainage area, which includes Virginia Lake. The outlet of Virginia Lake is controlled by a masonry and wood sluiceway with flashboards. The Lyme Timber Co. of Lyme, N.H., owns Virginia Lake Dam, but no one at the hearing knew who personally maintained the dam or controlled the position of the flashboards. Basic data on Virgina Lake Dam are included in Table 1. Since a major highway (Rt. 5) and possibly businesses and residences located downstream on Mill Brook could be adversely affected by a failure of Keewaydin Lake Dam, it should be able to pass safely a 100-year recurrence flood. I have checked the US Geological Survey

records to see whether there is any recorded information on historical flooding such as the 1936 flood and the 1953 flood. I have not been able to find any records of historical floods in this area, nor have I been able to find any gaging records that would be of use to this study. I have therefore estimated the 100-year flood by assuming that it would be produced by a 100-year recurrence rainfall, then routing this storm through the watershed and lakes by the Soil Conservation Service computer program, TR20. Table 2 summarizes the results of this analysis and Appendix A to this report is a copy of the computer printout. This analysis shows that the 100-year storm will result in the overtopping of the dam if the flashboards are maintained in the position that I observed them on 4/21/81. The soil areas downstream of the dam have not exhibited much resistance to overtopping of the dam. If the initial position of the flashboards was about 1 foot lower than observed on 4/21/81, the dam would not be overtopped by a 100-year storm, provided that the spillway was not plugged by an ice jam, etc.

7. In their petition for an inspection, the Stoneham Selectmen claimed that: "Should this dam let go, the water from the lake will innundate the town and would immediately wash out the bridge on Route 5 in Stoneham." My calculations suggest that a rapid failure of the entire Keewaydin Lake Dam is not likely and that the Route 5 bridge would probably survive a partial failure of the dam, unless it becameclogged with, for example, the debris from a washed out footbridge. The approximate height and extent of downstream flooding is difficult to predict and estimate, particularly in the absence of a detailed topographic survey of the downstream area. As a first approximation, I estimate that a 30-foot wide breach of the dam (the size breach that I would consider likely) would cause a rise in downstream waters of about 5 feet. I am unable to determine from the available topographic maps whether this would affect any residences or commercial property downstream; however, it does seem possible based upon the U.S. Geological Survey maps. Flood hazard maps have not yet been published for this part of Stoneham. Until a detailed flood hazard study has been made through the process of obtaining the detailed topographic information and using appropriate computerized modelling techniques, I must assume that damage to downstream buildings and roads is possible.

Conclusions

A. The Keewaydin Lake Dam has through-going cracks in the structural concrete which does allow some leakage through the dam. It is likely that not all of the dam is seated on ledge, and in fact some of the dam may be founded on wood which could deteriorate in time and/or compress under the weight of the dam. Some of the cracks in the dam could be indicative of differential settlement. While I do not believe that leakage alone poses a significant threat to the safety of the dam, I do believe that overtopping of the dam could result in an undermining of the foundation.

B. The Keewaydin Lake Dam has been overtopped in the past and my calculations show that it would be overtopped in a 100-year storm, which should be the design basis for the dam. The chances of overtopping will be reduced if the flashboards are lowered one foot from the position that I found them on 4/21/81. Lowering the lake level will also decrease the seepage pressure under and through the dam caused by leaking water. There is still a chance of overtopping, even with a lowered flashboard level, due to clogging of the spillway with ice chunks or other debris. Overtopping of the dam in the past has caused severe erosion on the downstream side of the dam.

C. The Keewaydin Lake dam does not have an emergency spillway and evidence from past overtopping of the dam suggests that the structural integrity of the dam could be affected by future overtopping. Although a detailed analysis of the impact of a breach of the dam on downstream areas is beyond the scope of this report, there is a possibility that downstream residences and/or commercial buildings could be damaged by such an event. The Town has offered no evidence to dispute this possibility and in fact the Selectmen, in their letter asking for the inspection, claim that the dam's failure would "inundate the Town and would immediately wash out the bridge on Route 5".

D. On the basis of the foregoing, I find that the Keewaydin Lake Dam, as presently maintained, is unsafe to the lives or property of persons residing, carrying on business, or employed near or below the same.

It is therefore, Ordered that:

1. Flashboards in the Keewaydin Lake Dam be lowered such that at no time will there be more than one foot from the sill of the spillway to the top of the flashboards. This lowering shall be made in increments of one-half foot per month, commencing with the first half-foot within one week of receipt by the Town of the final inspection report. This lowered position of the top of the flashboards will be maintained until such time as the dam owner either: a) constructs a suitable emergency spillway on the downstream side of the dam to allow for overtopping of the dam without erosion of the dam or spillway, or b) the Town can demonstrate through detailed engineering analysis that overtopping of the dam would not cause failure of the dam or that failure of the dam would not be unsafe or dangerous to the lives or property of persons residing, carrying on business or employed near or below the same.

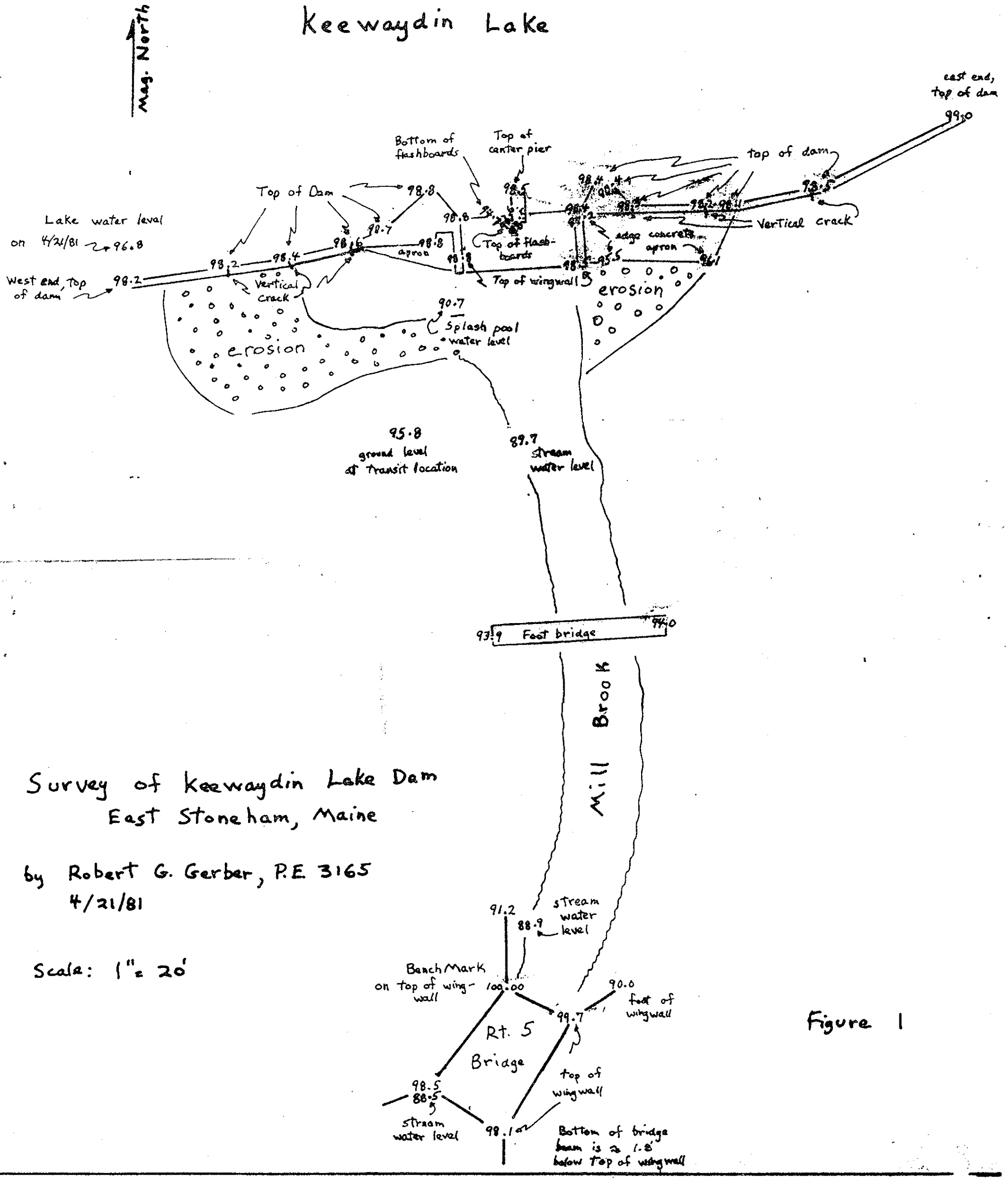
2. Within one year of its receipt of the Inspector of Dams' final report in this matter, the Town shall either: a) alter the dam to prevent the principal (or emergency) spillway from becoming clogged with ice or other debris, or b) provide a plan of action, satisfactory to the Inspector of Dams, for removal of such ice or debris within the two hours of the initiation of clogging.

As provided for in 38 MRSA §813, the Town of Stoneham shall reimburse the State of Maine for all costs associated with this inspection.

Dated this day of , 1981

Robert G. Gerber, P.E. 3165
State of Maine Inspector of Dams

# Keewaydin Lake




Survey of Keewaydin Lake Dam
East Stoneham, Maine

by Robert G. Gerber, P.E. 3165
4/21/81

Scale: 1" = 20'

Figure 1

TABLE 1--SUMMARY OF DAM CHARACTERISTICS

| Dam | Construction Material | Principal Spillway Width | Height from Spillway Sill to top of Dam | Method of Water Level Control | Height of top of gate above sill on 4/21/81 | Height of Lake Level above top of Sill on 4/21/81 |
|---|---|---|---|---|---|---|
| Keewaydin Lake Dam | masonry faced with concrete and concrete wingwalls | 22½ feet | 3.4 feet minimum | 2" wooden flashboards | 1.9 feet | 2.1 feet |
| Virginia Lake Dam | wooden gate and sluiceway supported by masonry | 3 feet minimum | 4½ feet | 2" wooden flashboards | 22 inches | 2½ feet |

TABLE 2--RESULTS OF FLOOD ANALYSIS*

| | Keewaydin Lake top of flashboards 1.9' above spillway sill | Keewaydin Lake top of flashboards 1.0' above spillway sill | Keewaydin Lake top of flashboards 0.0' above sill (i.e., no flashboards) |
|---|---|---|---|
| Peak Discharge, Virginia Lake Dam | 65 cubic feet per second (cfs) | 65 cfs | 65 cfs |
| Height of Water above top of Virginia Lake Dam | 0.15 feet | 0.15 feet | 0.15 feet |
| Peak Discharge, Keewaydin Lake Dam | 252 cfs | 246 cfs | 182 cfs |
| Height of Water above spillway sill of Keewaydin Lake Dam | 3.8 feet | 2.9 feet | 2.1 feet |
| Height of Water above top of Keewaydin Lake Dam | 0.3 feet | 0 feet (not overtopped) | 0 feet (not overtopped) |
| Total rise in Virginia Lake level | 2.8 feet | 2.8 feet | 2.8 feet |
| Total rise in Keewaydin Lake level | 1.9 feet | 1.9 feet | 2.1 feet |

*Based on 24-hour rainfall expected once every one hundred years

# TOWN OF STONEHAM

*OFFICE OF SELECTMEN*

EAST STONEHAM, MAINE 04231

March 10, 1981

Soil & Water Conservation Commission
State Office Building, Station 28
Augusta, Maine 04333

Gentlemen:

In complisnce with instructions received from your department, we, the Selectmen of Stoneham hereby submit this letter in the form of a petition.

Our problem concerns the Keewaydin Lake dam which was severely damaged in the storm of December 3 & 4. Should this dam let go, the water from the lake will innundate the town and would immediately wash out the bridge on Route 5 in Stoneham. This dam is registered with the State.

It is our request that an inspector be sent to examine the problem and possibly to supply answers as to what agency would assist us for the funding of necessary repairs.

Sincerely,

Frank J. Garvey

Frank J. Garvey,
Chairman, Board of Selectmen
Town of Stoneham

FJG:mtf

RECEIVED
SOIL & WATER CONSERVATION
MAR 17 1981
STATE HOUSE AUGUSTA, MAINE